Grower funded research has been the key to 50 years of rice industry advancement

50th

Fifty years ago this summer, the California rice industry made a profoundly important decision to secure a reliable source of funding for research into higher yielding varieties, improved cultural practices, and the tools to address environmental issues.

California had fallen behind the efforts of the Southern rice industry and other rice producing countries. Industry leaders at the time believed strongly that rapid improvements in production were needed for the state's growers to compete successfully in domestic and world markets.

Growers responded enthusiastically to a referendum held from June 13 to August 3, 1969 under the provisions of the California Marketing Act of 1937. It passed overwhelmingly, with 79 percent of participating growers voting in favor. This vote gave the industry the legal authority to create the California Rice Research Board, a new entity with the power to assess growers a small fee on paddy rice to fund a durable research program that would move the industry forward.

Up until this time, rice growers relied mostly on three tall-statured varieties: Colusa (1917), Caloro (1921), both short grains, and later the medium grain Calrose (1948). Calrose was significant because it enabled California to become the leading medium grain producing state in the nation. Today, about 90% of the rice grown in California is medium grain, with different types of short grains and long grains making up the rest.

Establishing the California Rice Research Board gave the industry the ability to build upon the Calrose foundation through the creation of an accelerated rice breeding program at the Rice Experiment Station in Butte County. Varietal improvement was the chief objective of the new marketing order for rice research, and it remains just as important today.

Well over 50,000 crosses for varietal improvement have been made since 1969. To date this has led to the development of 50 improved public rice varieties in 11 different market types. Some of the major improvements over the years include the development of smooth hulls that

NEW VARIETIES 1971–1981

- **1971**: CS-M3
- **1972**: CS-S4
- **1975**: M5, S6
- **1976**: Calrose 76
- **1978**: M7, M9
- **1979**: M-101, L-201, Calmochi-201
- **1980**: M-301, S-201
- **1981**: M-302, M-401, Calmochi-202

improved handling, shorter straw height that produces more grain and less straw, earlier maturing varieties, and improved milling yield and stability. The timeline at the bottom of this special section shows the steady development of new varieties.

Average yields were about 5,250 pounds/acre in 1969. With the advent of short-statured varieties, yields began to grow significantly—to 6,450 pounds/acre within 10 years. By 1985 average yields topped 7,400 pounds/acre. By 2008, statewide average yields were 8,300 pounds/acre. While rice quality and harvest characteristics have improved significantly over the years, yields began leveling off in the 1990s because of factors such as weather uncertainties and the phase out of rice field burning. Nonetheless, California rice yields today can and do exceed 10,000 pounds/acre, depending on the variety and good growing conditions.

In addition to the development of new rice varieties, other top priorities included development of crop residue

(continued)

How the California Rice Research Board makes decisions about projects to fund

The California Rice Research Board is made up of 11 grower members and their alternates, along with a public member and a liaison to the Rice Experiment Station. Board members represent one of three districts and serve three-year terms staggered a year apart to ensure consistency of oversight. The Board has principle responsibility for deciding the assessment rate and where to invest research funds and has developed a careful, deliberative process for ensuring that those funds are spent wisely.

Starting in November and December, board members serving on one of three research committees—genetics, pest management, and rice culture and utilization—meet to review preliminary results of research from the year just ending and recommend adjustments to project leaders. Once final proposals for continuing research have been received, a University of California technical advisory committee weighs in with opinions on the merits of those projects.

In late January the board receives full reports about the previous year's research and new project proposals. The board then has an opportunity in February to hear directly from researchers about new project proposals and to influence project direction as needed. The research committees make their recommendations on which projects to fund, research objectives to be included, and dollar amounts for each project. Projects are then ranked in order of importance and forwarded to an executive committee, which eliminates the lowest rated projects until the total research expenditure fits within the budget.

Finally, in late February or early March the full board meets once again to hear the executive committee's recommended list of projects. The board then discusses the complete list and typically modifies it. At the end of this discussion, the board votes to approve a specific list of projects for the current year.

1982–1991

1982
M-201

1984
L-202

1985
M-202
Calmochi-101

1987
M-102
A-301

1988
M-203
S-101

1989
M-103

1990
S-301

1991
L-203

The Rice Experiment Station hosts an annual field day the last Wednesday of August each year to show growers and others interested in California rice what's new. Director of Plant Breeding Virgilio Andaya spoke to growers about some of the most recently released varieties during the 2018 field day.

management systems that enhanced environmental quality, environmentally safe systems of weed, disease, and insect control, and improved management of crop fertilization and irrigation water. The industry has made significant strides in all these areas. The steady march of progress is documented every year in the pages of this annual report. The accompanying sidebar highlights major project areas from just the last 10 years alone.

Ongoing projects grow and evolve over the years. Weed management will always be an important issue, as will improving crop fertilization practices, protecting rice from pests and diseases, increasing water use efficiency, and bringing hard science to environmental challenges. Some projects may come and go while addressing an overall theme. The industry may not burn rice straw as it once did, but the board has funded quite a range of projects to find creative uses for it—in livestock feed, as insulating panels, and even in the development of nanomaterials with industrial applications.

The twin goals of all this work are to improve the productivity of California rice while taking into account agriculture's use of natural resources. These guiding principles have served the industry well, and the California Rice Research Board has been remarkably consistent and true to this mission since the day it was formed.

What of the next 50 years? We can't always predict tomorrow's problems. In fact, many of the unexpected things that have come up over the last 20 years have been a surprise. The sudden appearance of a problem, such as weed resistance, armyworm invasions, the blast fungus, or weedy red rice, reveals a core strength of this system by giving the California Rice Research Board the ability to quickly marshal the resources needed to address a problem.

The charge is to enable growers to produce the highest quality product and remain profitable in a sustainable manner. Thus, the board works to address the problems it can see today, while remaining ready to address unforeseen problems. It's a proven strategy and one that growers are banking on to secure the future of the California rice industry.

NEW VARIETIES 1994–2011

1994
M-204

1996
S-102
A-201
L-204

1999
M-402
Calhikari-201
Calmati-201
L-205

2000
M-104
M-205

2003
M-206

2005
M-207

2006
M-208
Calamylow-201
L-206
Calmati-202

2011
M-105

Research highlights from the last 10 years

Agronomics

- Alternative stand establishment
- Midseason surface nitrogen/preplant aqua
- Managing algae
- Field drainage timing
- Tadpole shrimp
- Armyworm monitoring and control
- Stinkbug relationship to peck
- Potassium status
- Fungicide evaluations
- Pecky rice study
- Degree day model for crop duration and irrigation
- Yield variability
- Salinity in no-spill systems
- Midseason nitrogen status
- Mycorrhizal fungi
- Improvement of leaf color chart
- Annual variety trials
- Seaweed extracts and biostimulants

Breeding

- New varieties—M-105 (2011), CH-202 (2012), A-202 (2013), M-209 (2014), CM-203 (2015), L-207 (2016), M-210 (2018), Calaroma-201 (2018)
- Screening mutants for herbicide tolerance—ROXY™ trait
- M-209 introduced as a new blast-resistant variety
- Profiling rice aroma volatiles
- Annual variety trials

Genetics

- DNA lab—new equipment, increased screening, quality markers, fingerprinting, marker-aided selection
- Yield related genes
- Mapping stem rot resistance
- Forward and reverse genetic screening

Weed control

- Alternative practices to control herbicide resistance
- Evaluation of commercially available and experimental herbicides
- Weed identification and diagnostic services
- Winged primrose control
- Weedy red rice control
- Spot spraying of weeds using drones

Postharvest

- Infrared drying
- Enhancing forage quality of rice hay
- Rice straw to ethanol
- Construction of two new greenhouses
- Rice waste to biodegradable plastic
- Nanomaterials and performance industrial products
- Dockage in harvested rice
- Stabilizing rice bran
- Rice strawlage as cattle feed
- Rice straw board development
- Rice straw fibers as a curing agent in concrete
- Improving concrete properties with rice straw ash

Environmental stewardship

- Predictive degree day model for water use efficiency
- Nitrogen leaching study for water quality
- Alternating wet/dry cultural practices
- Arsenic in groundwater, soil and surface water
- Mercury in rice
- Methyl mercury dynamics
- Herbicide drift in walnuts

2012–2018

- **2012** CH-202
- **2013** A-202
- **2014** M-209
- **2015** CM-203
- **2016** L-207
- **2018** M-210
- **2018** Calaroma-201